

SEDIMENT SAMPLING WORK PLAN

UPRIVER REACH BACKGROUND INVESTIGATION LOWER WILLAMETTE RIVER



Prepared for
OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY

PORTLAND, OREGON

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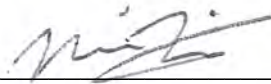
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*The material and data in this plan were prepared
under the supervision and direction of the undersigned.*

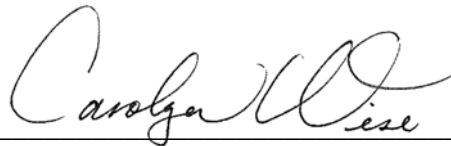
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ACRONYMS AND ABBREVIATIONS

| | |
|----------------|---|
| BERA | baseline ecological risk assessment |
| BHHRA | baseline human health risk assessment |
| CFR | Code of Federal Regulations |
| cm | centimeter |
| COC | contaminant of concern |
| CUL | cleanup level |
| DEQ | Oregon Department of Environmental Quality |
| dioxins/furans | polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans |
| DQO | data quality objective |
| EPA | U.S. Environmental Protection Agency |
| FSP | field sampling plan |
| MFA | Maul Foster & Alongi, Inc. |
| PHSS | Portland Harbor Superfund Site |
| QAPP | quality assurance project plan |
| RI | remedial investigation |
| RM | river mile |
| ROD | Record of Decision |
| Task Order | Task Order 73-18-15-001 between DEQ and MFA |
| TOC | total organic carbon |
| um | micrometer |
| Upriver Reach | Upriver Reach of the Lower Willamette River, RMs 16.6 to 28.4 |

1 INTRODUCTION

Maul Foster & Alongi, Inc. (MFA) has prepared this work plan on behalf of the Oregon Department of Environmental Quality (DEQ) to describe sediment sampling and data analysis in the Upriver Reach of the Lower Willamette River (the Upriver Reach) (see Figure 1-1). The Upriver Reach is located approximately 16.6 to 28.4 miles upstream of the confluence with the Columbia River (Willamette river miles [RMs] 16.6 to 28.4) and upstream of the Portland Harbor Superfund Site (PHSS) and the Downtown Reach. DEQ is coordinating with the U.S. Environmental Protection Agency (EPA) for this investigation. This work is being performed under Task Order 73-18-15-001 between DEQ and MFA (the Task Order).

1.1 Regulatory Framework

This work plan has been prepared with oversight by DEQ and EPA. All work outlined below will be conducted consistent with all applicable state and federal laws, rules, and regulations including, to the extent applicable to Code of Federal Regulations (CFR) Chapter 2, Part 200 and Chapter 40, Part 35.

1.2 Purpose and Objectives

Sediment collected from the Upriver Reach during the Portland Harbor remedial investigation (RI) was used to establish background conditions for the PHSS (EPA, 2016a). The calculated background concentrations informed cleanup levels (CULs) in the PHSS Record of Decision (ROD) for many riverbank soil and sediment contaminants of concern (COCs), including polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (dioxins/furans) (EPA, 2017). Following issuance of the ROD, a baseline study of the current conditions of the PHSS, the Downtown Reach, and the Upriver Reach was conducted with oversight by EPA (AECOM and Geosyntec, 2019). Based on the RI and baseline study results, there is uncertainty as to the representativeness of the background-based ROD riverbank soil and sediment CULs for dioxins/furans. The sampling activities described in this work plan will support an updated assessment of dioxin/furan background conditions that will inform an evaluation of CULs for riverbank soil and sediment established in the PHSS ROD (ROD cleanup levels are presented in Table 3-1 of Appendix B, Quality Assurance Project Plan [QAPP]).

The following are the objectives identified for this work plan:

- Gather data to establish unbiased sediment background concentrations for dioxins/furans in the Upriver Reach from appropriate and feasible sampling locations.
- Collect data to evaluate the influence of grain size on dioxin/furan concentrations.

- Collect data to evaluate whether potentially isolated, elevated concentrations of dioxins/furans are due to upstream source areas or anthropogenic background.¹

1.2.1 Work Plan Organization

Investigation activities will include collection and analysis of surface sediment samples to characterize dioxin/furan concentrations in the Upriver Reach.

Standard field operating procedures for collecting sediment samples, sample description, and decontaminating nondedicated equipment are described in the field sampling plan (FSP) provided as Appendix A. The QAPP defines the laboratory and analytical quality procedures and the quality assurance and quality control requirements for sampling and analysis and is provided as Appendix B. A health and safety plan specific to the activities described in this work plan is provided as Appendix C.

2 BACKGROUND AND PHYSICAL SETTING

The background and physical setting descriptions below are summarized from review of past environmental reports.

2.1 Upriver Reach Description and Physical Conditions

2.1.1 Surrounding Land Use

Land use surrounding the Upriver Reach is primarily residential and mixed-use residential, with some parks and open spaces. Relative to the PHSS and the Downtown Reach, industrial use in the Upriver Reach is limited and includes the Lake Oswego industrial area on the west bank between RMs 20.0 and 20.5, and two historical paper mills on both the west and east banks at approximately RM 26.0. The papermaking facilities began operating in the late 1800s (DEQ, 2017). Environmental information on the Blue Heron Paper Mill (ECSI #4811) and West Linn Paper Mill (ECSI #263) is available on DEQ's ECSI database. Information on DEQ's Upriver Sediment Investigation (ECSI 6220), which included collection of sediment samples just downstream of the mill area, also is available. It should be noted that paper bleaching at the mills using chlorine, which is a source of 2,3,7,8 tetrachlorodibenzo-p-dioxin and other dioxin/furan compounds, was discontinued circa 1970.

2.1.2 Archaeological Resources

As described in the RI, EPA is required to comply with federal statutes that provide for protection of archaeological and historical resources. EPA and DEQ signed a memorandum of understanding with

¹ This effort is not described herein; if further evaluation is indicated by the results of the unbiased sediment sampling results, it will be described in a future work plan addendum.

tribal governments and state agencies regarding cultural resources. In 2005, a survey of the Willamette River, from Willamette Falls to the confluence with the Columbia River and including adjacent upland areas, was performed (AINW, 2005).

DEQ is coordinating this sampling work with the State Historic Preservation Office and Tribes. As requested by the Tribes, all samples collected during this project will be examined by a professional archaeologist. If archaeological and/or cultural resources are discovered during the project, DEQ will contact the Tribes immediately by phone.

2.1.3 Topography and Bathymetry

The Upriver Reach of the Willamette River extends from RM 16.6 to RM 28.4 (from approximately the Sellwood Bridge to the confluence of the Tualatin and Willamette rivers in West Linn, Oregon). In contrast to the PHSS and the Downtown Reach, the Upriver Reach is less developed and flows under largely natural conditions through suburban areas of Portland (DEQ, 2017).

According to the U.S. Geological Survey Lake Oswego, Oregon, 7.5-minute series topographic map, the banks of the Upriver Reach are at elevations between 10 and 20 feet North American Vertical Datum of 1988.

2.1.4 Geology

The underlying geology of the Upriver Reach consists primarily of Quaternary alluvium underlain by Miocene Columbia River Basalt Group lavas. Many of the rivers and their tributaries in the Portland Basin were sculpted by the late Pleistocene Glacial Lake Missoula floods, which scoured much of the alluvium down to bedrock. The alluvium present in the Lower Willamette River is of Holocene age and consists of gravel, sand, silt, and clay. In the Upriver Reach, the Columbia River Basalt Group comprises at least three distinct basalt flows consisting of fine- to medium-grained basalt with sparse to abundant plagioclase and well-developed columnar jointing. Exposed basalt bedrock is present across much of the river bottom in the Upriver Reach (DOGAMI, 2009, 2012; USGS, 1983).

2.1.5 Aquatic Environment and Bottom Substrate

Strong river currents in the Upriver Reach appear to prevent sedimentation in much of the reach; where sediment is observed, it is generally coarser than sediment farther downstream in the Willamette River. In general, harder substrates are present between RMs 22 and 26, some sandy material is present between RMs 19 and 22 and increasing silty sand to sandy silt is present between RMs 16.6 and 19 (DEQ, 2017).

Between 1973 and 2018, average annual mean flow in the Willamette River was approximately 33,000 cubic feet per second at the Morrison Bridge near RM 12.8 (USGS, 2020).

2.2 Previous Investigations

2.2.1 2016 Lower Willamette Group Portland Harbor Superfund Site Remedial Investigation

In September 2001, EPA and the Lower Willamette Group entered into an Administrative Order on Consent to conduct an RI and feasibility study of the PHSS. The goal of the RI was to identify and characterize the extent of contamination in surface and subsurface sediment, fish and shellfish tissue, surface water, groundwater, and stormwater. A baseline human health risk assessment (BHHRA) and a baseline ecological risk assessment (BERA) were also conducted as part of the RI. The BHHRA evaluated the potential risk to human health from exposure to contaminants in sediment, surface water, and groundwater seeps, and from fish or shellfish tissue consumption. The BERA evaluated the potential risk to ecological receptors due to contact with and/or ingestion of contaminated media. The risk assessments identified 64 COCs that pose an unacceptable risk to human health and to ecological receptors. Data were also collected to characterize the fate and transport of contaminants due to hydrodynamic processes, including erosion, deposition, volatilization, and downstream transport. The RI included collection of surface sediment samples between 0 and 40 centimeters (cm) from the Upriver Reach to inform background concentrations for multiple COCs, including 39 samples that were analyzed for dioxins/furans (EPA, 2016a, b).

2.2.2 2017 DEQ—GSI Water Solutions Investigation

In 2017, nine composite surface sediment samples were collected from the Upriver Reach on behalf of DEQ. The sample locations had been selected to identify areas of elevated chemical impacts and areas with sediment accumulation. The sampling locations were biased toward areas of potential contamination and areas where there was sufficient fine-grained sediment to collect a sample. GSI and Hart Crowser indicated that the results of the investigation yielded biased high contaminant concentrations and were not representative of natural Upriver Reach conditions (GSI and Hart Crowser, 2018).

2.2.3 2018/2019 Pre-Remedial Design Group Investigation

Between 2018 and 2019, eight field studies were conducted on behalf of the Pre-Remedial Design Group². These studies included a bathymetry survey, surface sediment sampling, subsurface sediment coring, sediment trap sampling, surface water sampling, fish tissue sampling, a fish tracking study, and background porewater sampling. Within the Upriver Reach, a total of 30 stratified random samples were collected between 0 to 30 cm to characterize background conditions for multiple COCs, including dioxins/furans (AECOM and Geosyntec, 2019).

² The Pre-Remedial Design Group consists of Arkema, Inc.; Evraz Oregon Steel; Schnitzer Steel Industries, Inc.; and The Marine Group, LLC.

2.2.4 2020 DEQ—Hart Crowser Investigation

In October 2019, Hart Crowser conducted surface sediment sampling in the Upriver Reach on behalf of DEQ. The purpose of this investigation was to collect additional sediment data to assess the extent of contaminants of interest in two areas identified during the 2018 GSI investigation. The investigation areas were located between RM 16.0 and 16.3, east adjacent to Sellwood Riverfront Park and Oaks Amusement Park; and at RM 19.6, west adjacent to a residential area (GSI and Hart Crowser, 2020).

3 SCOPE OF WORK

This section describes the objectives and scope of work for the investigation. The field investigations will be conducted in general accordance with the methods and protocol described in the FSP (Appendix A).

3.1 Problem Statement

The Upriver Reach has been sampled to establish background conditions for the PHSS. As described above, there is uncertainty as to the representativeness of the background-based ROD riverbank soil and sediment CULs for dioxins/furans. The sampling activities described in this work plan, along with other post-ROD baseline data, will improve the understanding of dioxin/furan background conditions in the Upriver Reach and will inform PHSS ROD background-based riverbank soil and sediment CULs for the PHSS.

Data quality objectives (DQOs) for this study are provided in Table 4-1 of the QAPP. DQOs are used to establish performance and acceptance criteria, which serve as the basis for designing a plan for collecting data of sufficient quality and quantity to support the goals of the study (EPA, 2002).

3.2 Investigation Approach

Investigation activities will include collection and analysis of stratified random surface sediment samples to characterize dioxin/furan concentrations in the Upriver Reach. Up to 45 three-point composite surface sediment samples over multiple sediment grain-size fractions (resulting in an estimated 135 unbiased samples) will be collected between 0 and 30 cm and submitted for analysis of dioxins/furans, total organic carbon (TOC), and grain-size distribution. For each composite sample, dioxin/furan concentrations and TOC will be determined for bulk sediment and two grain-size fractions: sediment that passes a No. 10 sieve (<2,000 micrometers [um]) and sediment that passes a No. 230 sieve (<62 um).

3.2.1 Study Goals

The study goals for this investigation are:

- Establish unbiased background concentrations for dioxins/furans in the Upriver Reach from appropriate and feasible sample locations.
- Evaluate the influence of grain size on dioxin/furan concentrations as certain grain size fractions (i.e., smaller particles) are more prone to transport.
- Evaluate the influence of TOC on dioxin/furan concentrations.
- Evaluate whether potentially isolated, elevated concentrations of dioxins/furans are due to upstream source areas or anthropogenic background.³

3.2.2 Study Design

Surface sediment sampling will be conducted consistent with the FSP (see Appendix A). Sampling will consist of the collection of 45 stratified random three-point composite surface sediment samples. The stratified random sample stations were assigned by MFA's subcontractor, Cascadia Associates. Proposed surface sediment sampling stations are shown in Figures 3-1 through 3-5.

3.2.3 Field Methodology

Discrete surface sediment samples for composite analysis will be collected to a depth of 30 cm below mud line, using a pneumatic power grab sampling device. Before deploying the power grab sampler, field personnel will probe the sediment bottom, using a steel-tipped rod to confirm the presence of fine-grained material. Flappers will be installed on the grab sampler to minimize any sediment or particulate accumulation from the water column on the surface of the sample. The sediment sample will be inspected upon retrieval to ensure that the grab sampler was completely closed and retained all sediment, including any surficial fines. The archaeologist will inspect surface sediment samples for archaeological and/or cultural resources before the samples are composited. Once the first grab sample is accepted and processed by staff on board, the second and third discrete samples will be collected from the anchored sampling vessel until there is an equal volume of sediment from the three grabs. The three subsample locations will be from within a 25-foot- or 50-foot- (if greater than six attempts are needed) radius of the target location.

After processing, sediment grabs will be stored on ice in stainless-steel bowls covered with aluminum foil until ready for compositing. Once composited, samples will be placed in laboratory-provided glass jars for analysis. A summary of analytical methods, performance criteria, and reporting limits is provided in Table 2-3 of the QAPP (see Appendix B). Tables 4-2 through 4-4 of the QAPP provide details on containers and preservation requirements and field and laboratory quality control sample frequency (see Appendix B). Additional details on field methodology are provided in the FSP (see Appendix A).

³ This evaluation is not described herein; if further evaluation is indicated by the results of the unbiased sediment sampling results, it will be described in a future work plan addendum.

3.2.4 Lab Methodology

The selected analytical methods, performance criteria, and laboratory reporting limits are provided in Table 2-3 of the QAPP. Surface sediment samples will be submitted to the laboratory for analysis of dioxins/furans by EPA Method 1613B, TOC by EPA Method 9060A, and grain-size distribution by ASTM D-422 modified (the modification to ASTM D-422 includes an additional sieve, no. 230).

Sediment samples will be analyzed for grain size distribution, bulk TOC, and bulk dioxin/furans. Grain size fractions will also be analyzed for TOC and dioxin/furans following laboratory dry sieving. The specific grain size intervals for analysis of dioxin/furans and TOC include sediment that passes a No. 10 sieve (<2,000 um) and a No. 230 sieve (<62 um).

3.3 Reporting

MFA will prepare and submit a report describing the completed work, including description and documentation of the fieldwork, data validation memoranda, tables and figures summarizing the sampling effort, and evaluation of the analytical results. Data validation and data management will be performed in accordance with the QAPP (Appendix B).

3.4 Supporting Documents

To inform the DQOs and guide the procurement of an analytical laboratory, MFA has prepared a Laboratory Survey Approach and Methods memorandum (MFA, 2020a) and a subsequent Laboratory Survey Results memorandum (MFA, 2020b).

4 PROJECT MANAGEMENT PLAN

4.1 Project Organization

Project management for implementation of this work plan, including planning, coordination sampling, documentation, and reporting tasks, will be undertaken by MFA. All project work will be supervised by an Oregon-registered geologist employed at MFA. MFA will use subcontractors for various activities, including sediment sampling and laboratory services. Stakeholders and MFA subcontractors involved with this project are listed below.

4.1.1 Roles and Responsibilities

MFA will lead the investigation activities described in this work plan. In addition to MFA staff, the following are responsible for the successful execution of the investigation scope of work and achievement of the objectives described in this work plan.

4.1.1.1 DEQ

The DEQ is the lead agency for the Upriver Reach activities. DEQ will oversee the investigation activities described in this work plan.

4.1.1.2 EPA

DEQ has received a grant from EPA to conduct this work and will be coordinating with EPA throughout the implementation. EPA and the other Technical Coordinating Team parties will review and provide feedback on project deliverables (e.g., work plan, field sampling and data report). EPA will be assisted in the review of technical documents by their contractor, CDM Smith.

4.1.1.3 Selected Subcontractors

The selected subcontractors providing services to support this investigation will perform work in strict compliance with this work plan, the FSP, the QAPP, and contract requirements related to the scope of work for the investigation. The subcontractors are responsible for implementation of work assignments under the direction of the MFA project manager. Subcontractor firms will be selected for work once DEQ has approved this work plan.

4.1.2 Communication Strategy

The communication strategy is described in detail in Section 2 of the QAPP (see Appendix B). The field coordinators, Ms. Carolyn Wise and Ms. Meaghan Pollock, will be the points of contact for field personnel during the implementation of this work plan. Deviations from this FSP or the QAPP will be reported to Mr. Elliott for consultation. Significant deviations from the FSP or QAPP will be reported to Mr. Mark Pugh (DEQ's project manager) for approval. Significant deviations include any change that may impact achieving the DQOs (Table 4-1 of the QAPP) or any changes that may impact the use of the data to be generated. If archaeological and/or cultural resources are encountered during sampling, Mr. Elliott will notify DEQ, who, in turn, will notify the Tribes immediately.

4.2 Deliverables

As outlined in the Task Order, deliverables will include:

4.2.1 Phase I Field Sampling and Data Report

The phase I field sampling and data report will summarize the results of the field work and analytical results. The report will include, at a minimum, the following:

- Descriptions of any deviations from this work plan.
- Sample descriptions and photographs.
- Maps showing attempted and successful sample locations.
- Data validation and data usability review.

- Tables summarizing analytical results.
- Identification of concentrations (if any) that may indicate a nearby source of contamination, rather than ubiquitous background conditions.
- Identification of any additional data gaps.

4.2.2 Work Plan Addendum

If the phase I field sampling and data report identifies concentrations that may indicate a nearby source of contamination or data gaps, MFA will prepare a work plan addendum that describes targeted sampling and analysis of up to 150 single point surface sediment samples and any work proposed to fill in identified data gaps. Targeted sample locations will be established on transects based on MFA's desktop review of unbiased sample results and sample location features/structures (e.g., docks, riverbank features).

4.3 Schedule

| Task | Start Date | Completion |
|----------------------------|--|------------------------------|
| Prepare draft work plan | August 2020 | October 30, 2020 |
| Prepare final work plan | Following DEQ, EPA, and Portland Harbor Technical Coordination Team comments. | December 11, 2020 |
| Fieldwork | Following DEQ and EPA approval of the work plan. Timeframe requested by DEQ/EPA. | March 15, 2021–April 2, 2021 |
| Laboratory Analysis | Following sample collection | April 2021 |
| Prepare draft report | After completion of fieldwork and receipt of final data packages. | April-May 2021 |
| Data Validation | After receipt of final data packages | May 3-14, 2021 |
| Data Review and Assessment | Following data validation | May 17-28, 2021 |
| Prepare final report | Receipt of DEQ and EPA comments on draft report. | June-July 2021 |

The time frames for the work to be performed may change, based on changes to the scope of work and issues involving Upriver Reach access, and subject to subcontractor availability and DEQ approval.

LIMITATIONS

The services undertaken in completing this plan were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This plan is solely for the use and information of our client unless otherwise noted. Any reliance on this plan by a third party is at such party's sole risk.

Opinions and recommendations contained in this plan apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this plan.

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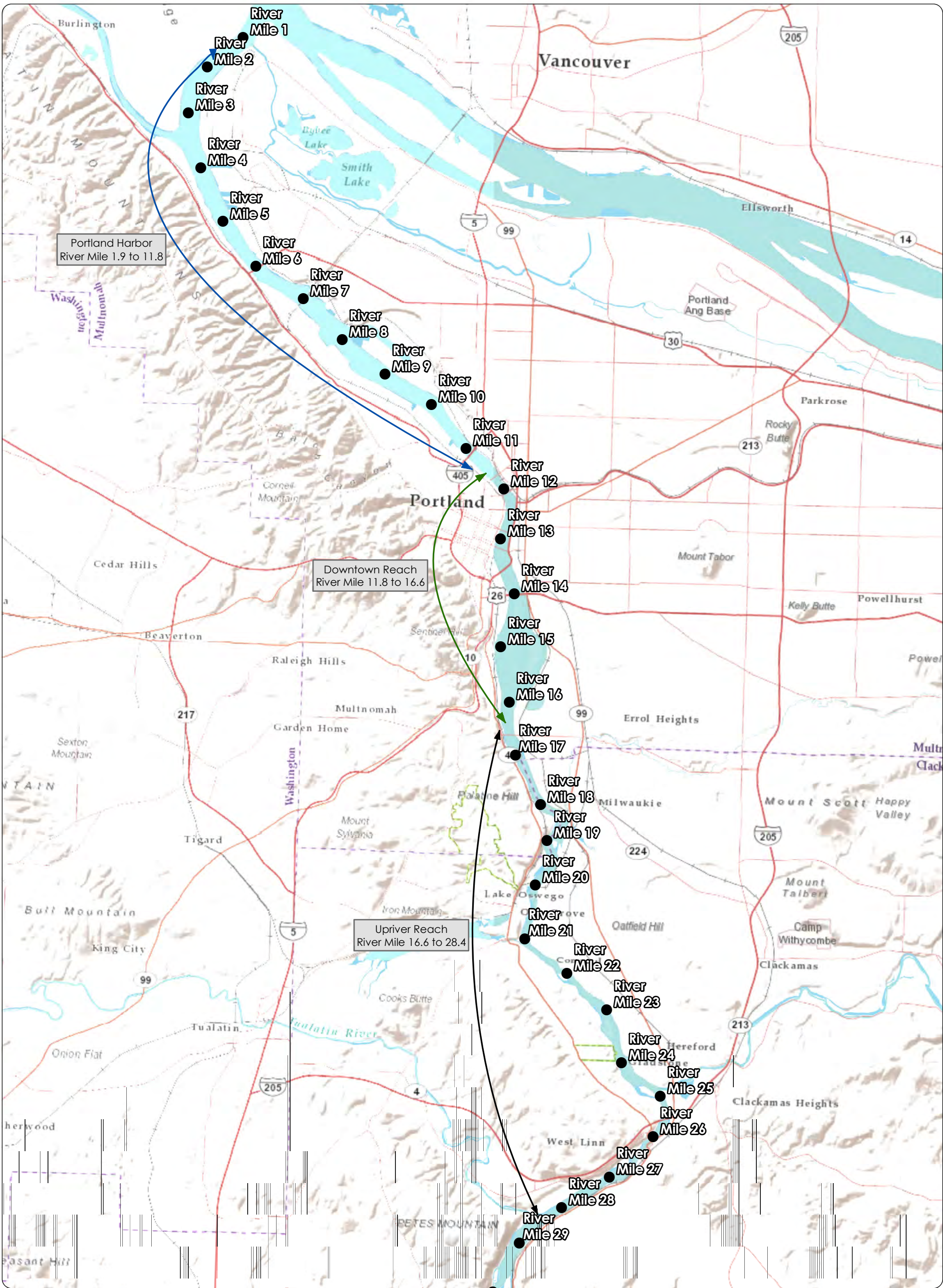
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FIGURES





Legend

● River Mile Marker

Figure 1-1
Willamette Upriver Reach
Background Investigation
DEQ
Portland, Oregon

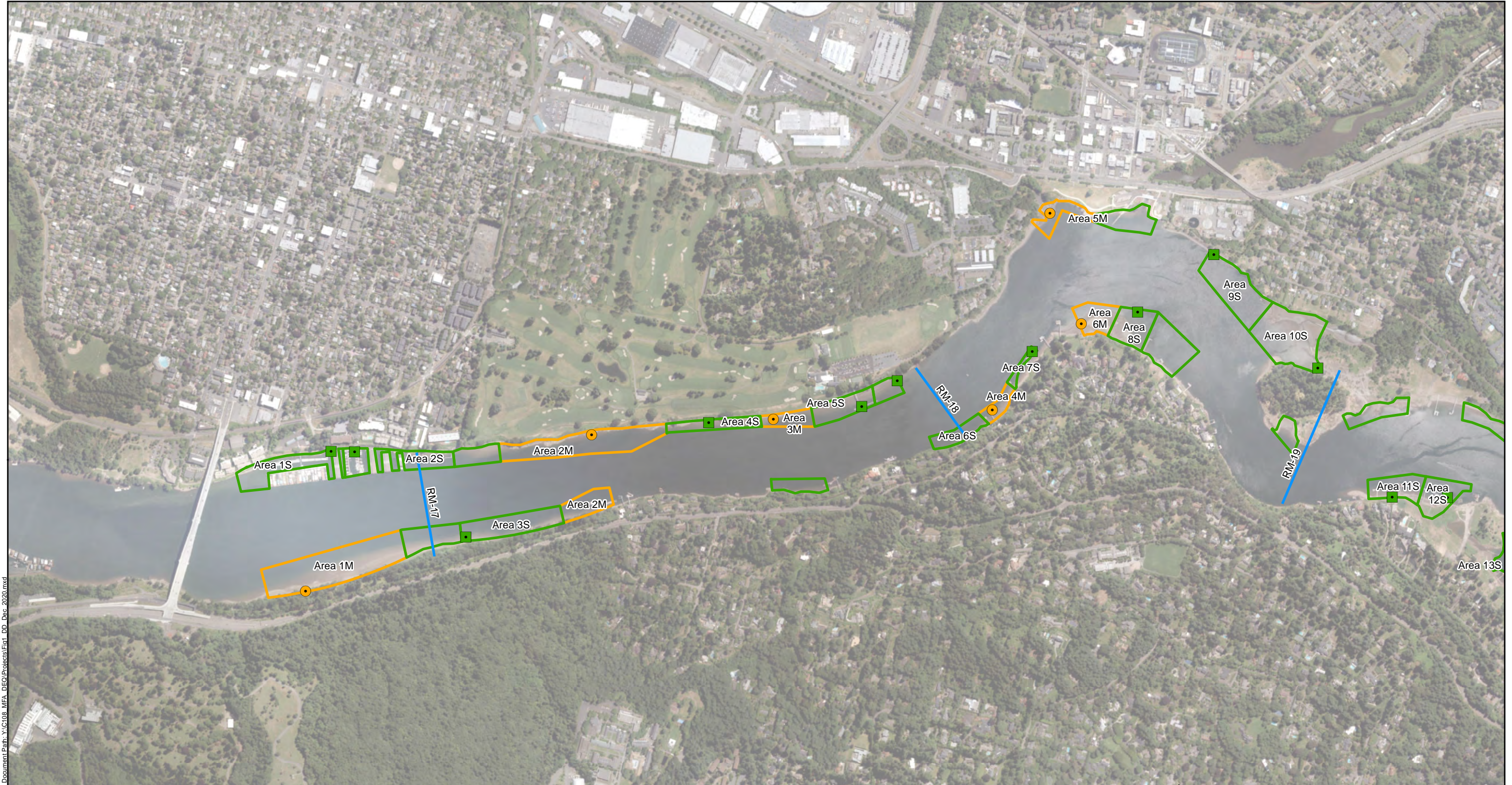
Source:
Basemap obtained from ArcGIS Online.

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0 4,500 9,000
Feet





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- Proposed Soft Sediment FSP Grab Sample Location (n = 30)
 - Proposed Medium Sediment FSP Grab Sample Location (n = 15)
 - Soft Sediment Analysis Grid
 - Medium Sediment Analysis Grid
- River Mile (RM)

0 250 500 1,000
Feet



NOTE:
Points were generated randomly inside the Hand Probe Polygons
in each of the Analysis Grids using the Create Random Points tool in ArcGIS 10.x.

Proposed Upriver Reach Surface Grab Locations RM 16.6-19.0

DEQ – Willamette Upriver Reach
Background Investigation
Portland, Oregon

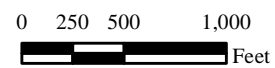


Figure
3-1



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- Proposed Soft Sediment FSP Grab Sample Location (n = 30)
 - Proposed Medium Sediment FSP Grab Sample Location (n =15)
 - Soft Sediment Analysis Grid
 - Medium Sediment Analysis Grid
- River Mile (RM)

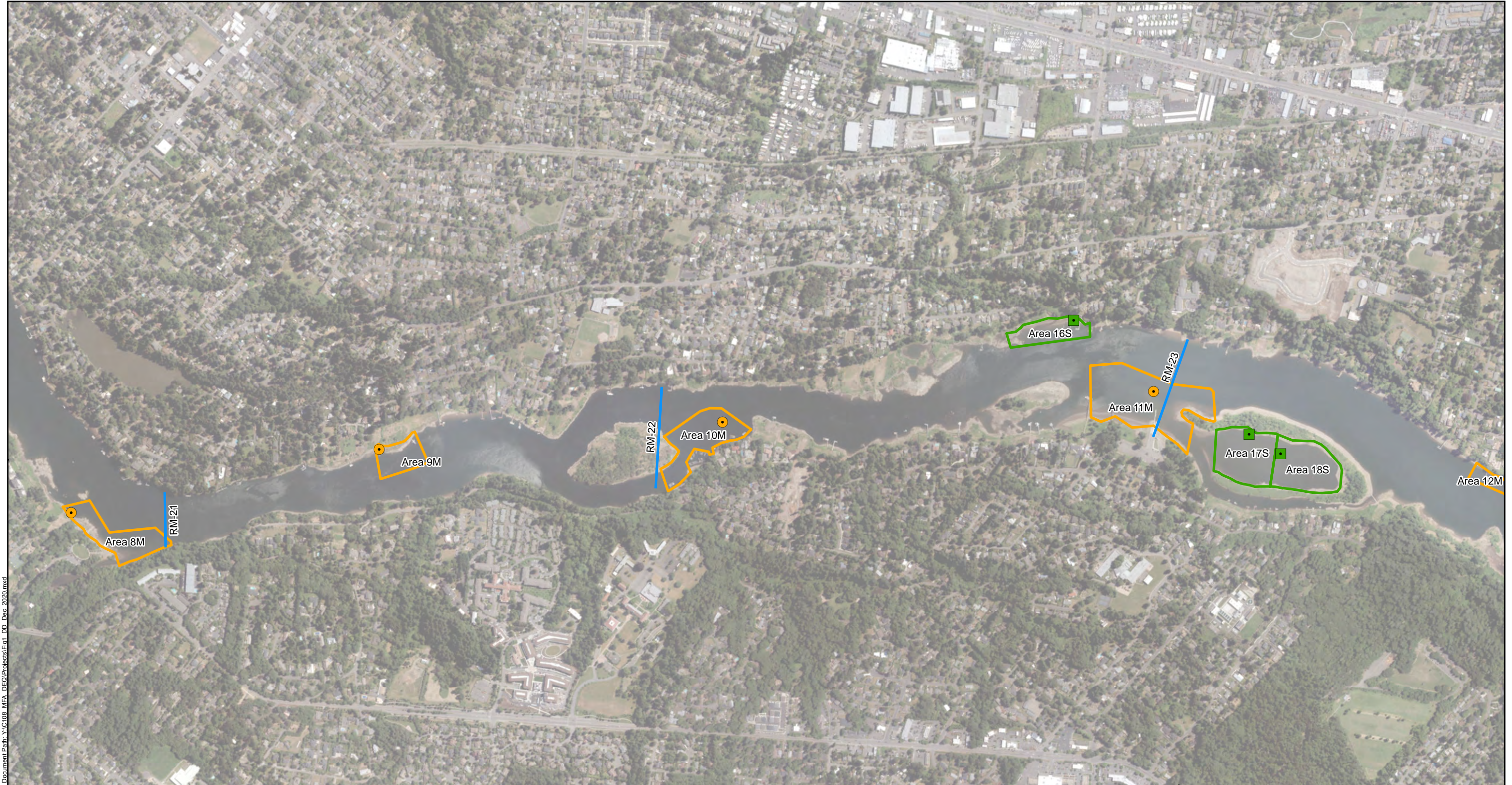


NOTE:
Points were generated randomly inside the Hand Probe Polygons
in each of the Analysis Grids using the Create Random Points tool in ArcGIS 10.x.

**Proposed Upriver Reach
Surface Grab Locations
RM 19.0-21.0**

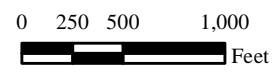
DEQ – Willamette Upriver Reach
Background Investigation
Portland, Oregon





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- Proposed Soft Sediment FSP Grab Sample Location (n = 30)
 - Proposed Medium Sediment FSP Grab Sample Location (n = 15)
 - Soft Sediment Analysis Grid
 - Medium Sediment Analysis Grid
- River Mile (RM)



NOTE:
Points were generated randomly inside the Hand Probe Polygons
in each of the Analysis Grids using the Create Random Points tool in ArcGIS 10.x.

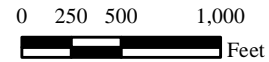
**Proposed Upriver Reach
Surface Grab Locations
RM 21.0-23.0**
DEQ – Willamette Upriver Reach
Background Investigation
Portland, Oregon





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- Proposed Soft Sediment FSP Grab Sample Location (n = 30)
- Proposed Medium Sediment FSP Grab Sample Location (n =15)
- Soft Sediment Analysis Grid
- Medium Sediment Analysis Grid
- River Mile (RM)



NOTE:
Points were generated randomly inside the Hand Probe Polygons
in each of the Analysis Grids using the Create Random Points tool in ArcGIS 10.x.

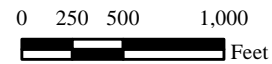
**Proposed Upriver Reach
Surface Grab Locations
RM 23.0-26.0**
DEQ – Willamette Upriver Reach
Background Investigation
Portland, Oregon





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- Proposed Soft Sediment FSP Grab Sample Location (n = 30)
 - Proposed Medium Sediment FSP Grab Sample Location (n =15)
 - Soft Sediment Analysis Grid
 - Medium Sediment Analysis Grid
- River Mile (RM)



NOTE:
Points were generated randomly inside the Hand Probe Polygons
in each of the Analysis Grids using the Create Random Points tool in ArcGIS 10.x.

**Proposed Upriver Reach
Surface Grab Locations
RM 26.0-28.4**
DEQ – Willamette Upriver Reach
Background Investigation
Portland, Oregon



APPENDIX A

FIELD SAMPLING PLAN



APPENDIX B

QUALITY ASSURANCE PROJECT PLAN



APPENDIX C

HEALTH AND SAFETY PLAN

